Remarks

This amendment is responsive to the Office Action mailed November 20, 2002 in connection with the above-identified patent application. In that Action, independent claim 5 was withdrawn from further consideration under 37 C.F.R. § 1.142(b). Claims 11, 12, 13, 18, and 19 were rejected under 35 U.S.C. § 101 as being drawn to two statutory classes of inventions, a product and a process of making. Claims 18 and 19 were rejected under 35 U.S.C. § 102(b) as being anticipated by published International Application WO 96/22629. Claims 1, 11-14, 18, and 19 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,426,771 to Wang, et al. Lastly in the Action, claims 15-17 were indicated as containing allowable subject matter.

THE NON-ART REJECTIONS

Referring again to the Office Action and to repeat, claims 11, 12, 13, 18, and 19 were rejected under 35 U.S.C. § 101. According to the Examiner, the claims are drawn to two statutory classes of inventions, a product and a process of making.

Applicants respectfully disagree with the Examiner's position with regard to the rejection of any claims in the instant application under 35 U.S.C. § 101. More particularly, all of the claims pending in the instant application are respectfully submitted as being directed to statutory subject matter. As correctly noted by the Examiner, Section 101 of Title 35 permits patents to be granted only for "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof." Section 706.03(a) of the MPEP lists several categories of subject matter not patentable under the statute including printed matter, naturally occurring

articles, scientific principles, and items which are inoperative or otherwise lack utility. It is respectfully submitted that none of the pending claims in the instant application are directed to those categories or items.

Applicants have amended each of claims 18 and 19 into independent form to recite a stator product made by a particular process. Applicants respectfully direct the Examiner's attention to MPEP § 2113 whereat the procedures for examining product by process claims are listed.

Applicants respectfully request that the Examiner follow the MPEP and at least § 2113 in particular in examining independent claims 18 and 19.

THE ART REJECTIONS

With reference yet once again to the Office Action, claims 18 and 19 were rejected as being anticipated by WO-629. The Examiner took the position that the WO-629 publication discloses the final structure of four groups of conductors on stator teeth.

Also in the Office Action, claims 1, 11-14, 18, and 19 were rejected as being anticipated by U.S. Patent No. 4,426,771.

The Present Application:

For purposes of review, the present application is directed to improvements in stator constructions and methods of winding a stator to realize an improved efficiency thereof. As described in the specification, the invention proceeds from the recognition that as a result of dividing winding procedures for coupled coils of opposite phases into partial winding steps, significant simplification is realized in the manufacturing method and improved efficiencies result.

In comparison with stators produced according

known methods, the methods and apparatus of the present invention to improve magnetic coupling of the coils of the respectively opposite phases. As outlined in the specification, this can be explained in part in that with simultaneous winding of all wires of two coils according to the prior art practice, and allocation of the wire ends after the winding procedure, there was, more or less, random allocation and positioning of the individual wires within one coil. In contrast, in accordance with the present application, by separation of the windings into partial winding steps, closer proximity of the individual wires of the coils is achieved, at least on balance, for more uniform distribution resulting in improved results. In accordance with the preferred embodiment of the invention, by winding only two wires respectively (one per coil) the two wires are placed close to each other over the entire length of the coil.

As a further benefit, the improve coupling and close proximity of the wire pairs results in an improved ability of replicating electrical properties of the stator. More particularly, stators wound according to the preferred method have consistent properties overall.

Claims 18 and 19 are Patentable Over WO-629:

As noted above, the Examiner took the position that claims 18 and 19 were anticipated by WO-629. The Examiner noted in the Action that WO-629 discloses the final structure of four groups of conductors on stator teeth.

Applicants respectfully submit that independent claims 18 and 19 as amended above are patentably distinct and unobvious over the WO-629 reference. More particularly, independent claim 18 recites a stator having teeth and a set of conductors wound onto the teeth. The conductors are wound by performing a series of partial winding procedures.

The conductor pairs are essentially "layered" onto conductors wound in previous partial winding steps. This construction, as noted above, results in improved efficiencies in the stator properties and in improved consistency between individual stators.

It is respectfully submitted that the WO-629 patent does not teach, suggest, or fairly disclose a stator having conductors wound thereon in partial winding steps.

Claims 1, 11-14, 18, and 19 are Patentably Distinct and Unobvious Over the Wang, et al. '771 Patent:

Claims 1, 11-14, 18, and 19 were rejected as being anticipated by the Wang, et al. '771 patent. This rejection is respectfully traversed.

U.S. Patent No. 4,426,771 to Wang, et al. teaches a method of fabricating a stator for a multiple-pole dynamo electric machine having a plurality (e.g. 18) poles. The machine or motor has an auxiliary winding A and a main winding M. Auxiliary winding A includes a first auxiliary winding coil set AC1 and a second auxiliary winding coil set AC2. Main winding M includes a first main winding coil set MD1 and a second main winding coil set MD2. The coils of each coil set are electrically connected together by a magnet wire in an electrical connection pattern as generally shown in Figure 10 of the '771 patent.

In accordance with the teachings of the '771 patent, the first and second auxiliary winding coil sets AC1 and AC2 and the main winding coil sets MC1 and MC2 are inserted in corresponding slots of core 5 so that the coils of these coil sets are grouped together in a layered fashion in core 5 as generally shown in Figures 2 and 3 of the '771 patent and described therein beginning at column 4, line 40 - column 5, line 20.

As further described in column 5, at line 41 -

column 6, line 18, the coil sets AC1, MC1, AC2, MC2 are inserted into their respective slots in succession. Thus, the teachings of the '771 patent are clearly different from the method according to the present invention.

The '771 patent teaches dividing the main and auxiliary coils of the motor into coil sets and inserting the coils of the first and second coil sets of the auxiliary winding in the same slots with the coils of the main winding coils being interleaved therebetween but not inserted into the same slots. Apparently, this leads to the advantage that only two relatively small coils need to be inserted into the slots for the auxiliary winding or in the slots for the main winding, thus permitting the end turns of each of the coils to be bent to a relatively small radius and thus permitting the size of the end turns E of the windings W to be substantially reduced from the prior art motors. It is described in the '771 patent at column 5, line 61 - column 6, line 5.

Taking the above description and structure described above together with the advantages also described according to the '771 patent, it is clear that none of the windings AC1, AC2, MC1, MC2 can be wound simultaneously. The '771 patent makes no mention of simultaneously winding coils onto stator teeth.

According to the above, therefore, it is respectfully submitted that the '771 patent does not teach, suggest, or fairly disclose the invention of the subject application.

Turning now to independent claim 1, a method is recited for winding a stator of a brushless direct current motor including the steps of simultaneously winding each of the stator teeth in several partial winding steps, with an even number of 2n conductors allocating a first set of n conductors of the 2n conductors to a first coil and

allocating the other set of n conductors of the 2n conductors to the other coil, and repeating this step until the predetermined number of conductors per coil has been reached.

It is respectfully submitted that independent claim 1 includes limitations not taught or suggested in the '771 patent such as and including the step of simultaneously winding stator teeth in several partial steps and repeating the partial winding steps until a predetermined number of conductors has been reached. Again, each of the coils are wound separately and then inserted into the stator according to the teachings of the '771 patent.

Independent claim 11 includes limitations not taught, suggested, or fairly disclosed in the '771 patent. A coil winding method is described including the steps of a first partial coil winding step simultaneously winding to n conductors together onto a first plurality of stator teeth, selecting first and second groups of conductors and assigning the first and second group of conductors to first and second coils of a set of magnetically coupled coil pairs, and repeating these steps until a predetermined number of conductors are wound onto a plurality of stator teeth to form a first magnetically coupled pair of a set of magnetically coupled coil pairs.

Again, it is respectfully submitted that the '771 patent does not teach, suggest, or fairly disclose a coil winding method including a series of partial coil winding steps which are repeated until a predetermined number of coils are wound onto a plurality of stator teeth. This limitation is clearly set forth in independent claim 1 of the present application.

For at least the above reasons, it is respectfully submitted that independent claim 11 and claims 12-17 dependent therefrom are patentably distinct and unobvious

over the reference of record.

Conclusion

In view of the above amendments, comments, and arguments presented, applicants respectfully submit that all pending claims are patentably distinct and unobvious over the references of record.

Allowance of all claims and early notice to that effect is respectfully requested.

Respectfully submitted,

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MARKED-UP VERSION OF AMENDED CLAIMS

February 20, 2003

IN THE CLAIMS:

Please amend claims 1, 11-13, 18, and 19.

Please add new claims 20 and 21.

1. (Three Times Amended) A method for winding a stator of a brushless direct current motor[, which has] having a stator body [(9)] with a pre-determined number of [to be] wound stator teeth [(3)], wherein the stator teeth [(3)] are respectively wound with two coils [(W1, W3; W2, W4),] which are magnetically coupled and which permit the generation of opposite magnetic fields by the supply of current with variable directional orientation, and wherein each of the two coils [(W1, W3; W2, W4)] comprises a predetermined number of conductors, the method comprising the steps of:

a) simultaneously winding each of the stator teeth [(3)] in several partial winding steps, with an even number of 2n conductors allocating a first set of n conductors of the 2n conductors to a first coil and allocating the other set of n conductors of the 2n conductors to the other coil; and,

b) [performing a predetermined number of partial winding procedures] repeating step a) until the predetermined number of conductors per coil [(W1, W3; W2, W4)] has been reached.

11. (Amended) A coil winding method for winding a predetermined number of conductors [(25, 27)] to form a set of magnetically coupled coil pairs [(W1, W3,; W2, W4;...)] on a plurality of stator teeth [(3)] of a stator body [(9)] in a [brushless direct current] motor, each set

of coil pairs [(W1, W3, W2, W4;...)] generating opposing magnetic fields in the plurality of stator teeth, [(3),] the coil winding method comprising the steps of:

a) in a first partial coil winding step, simultaneously winding 2n conductors [(25, 27)] together onto a first plurality of stator teeth of said stator body;

b) selecting a first group n_1 [(25)] of said 2n conductors and assigning the first group n_1 [(25)] to a first coil [(W1)] of said set of magnetically coupled coil pairs;

c) selecting a second group n_2 [(27)] of said 2n conductors and assigning the second group n_2 [(27)] to a second coil [(W3)] of said set of magnetically coupled coil pairs; and,

d) repeating steps a) through c) until said predetermined number of conductors are wound onto said first plurality of stator teeth to form a first magnetically coupled coil pair [(W1, W3)] of said set of magnetically coupled coil pairs [(W1, W3; W2, W4;...)].

12. (Amended) The method according to claim 11 further including:

winding said predetermined number of conductors on a second plurality of stator teeth of said stator body [(9)] in said [brushless direct current] motor to form a second magnetically coupled coil pair [(W2, W4)] of said set of magnetically coupled coil pairs [(W1, W3; W2, W4;...)].

13. (Amended) The method according to claim 12 wherein the step of winding said predetermined number of conductors on said second plurality of stator teeth includes the steps of:

e) in a second partial coil winding step, simultaneously winding 2n conductors together onto a second plurality of stator teeth of said stator body;

f) selecting a third group n_3 of said 2n conductors and assigning the third group n_3 to a third coil [(W2)] of said set of magnetically coupled coil pairs;

g) selecting a fourth group n_4 of said 2n conductors and assigning the fourth group n_4 to a fourth coil [(W4)] of said set of magnetically coupled coil pairs; and,

h) repeating steps e) through g) until said predetermined number of conductors are wound onto said second plurality of stator teeth to form said second magnetically coupled coil pair [(W2, W4)] of said set of magnetically coupled coil pairs [(W1, W3; W2, W4;...)].

18. (Amended) A stator [made using the steps according to claim 11] having a stator body defining a plurality of stator teeth carrying conductors to form a set of magnetically coupled coil pairs, the conductors being wound onto said stator teeth by:

a) in a first partial coil winding step, simultaneously winding 2n conductors together onto a first plurality of stator teeth of said stator body;

b) selecting a first group n_1 of said 2n conductors and assigning the first group n_1 to a first coil of said set of magnetically coupled coil pairs;

c) selecting a second group n_2 of said 2n conductors and assigning the second group n_2 to a second coil of said set of magnetically coupled coil pairs; and,

d) repeating steps a) through c) until said predetermined number of conductors are wound onto said first plurality of stator teeth to form a first magnetically coupled coil pair of said set of magnetically coupled coil pairs.

19. (Amended) A stator [made using the steps according to claim 13] having a stator body defining a

plurality of stator teeth carrying conductors to form sets of magnetically coupled coil pairs, the conductors being wound onto said stator teeth by:

a) in a first partial coil winding step, simultaneously winding a first pair of conductors together onto a first plurality of stator teeth of said stator body;

b) selecting a first group n_1 of said first pair of conductors and assigning the first group n_1 to a first coil of said set of magnetically coupled coil pairs;

c) selecting a second group n_2 of said first pair of conductors and assigning the second group n_2 to a second coil of said set of magnetically coupled coil pairs;

d) repeating steps a) through c) until a predetermined number of conductors are wound onto said first plurality of stator teeth to form a first magnetically coupled coil pair;

e) in a second partial coil winding step, simultaneously winding a second pair of conductors together onto a second plurality of stator teeth of said stator body different from said first plurality of stator teeth;

f) selecting a third group n_3 of said second pair of conductors and assigning the third group n_3 to a third coil of said set of magnetically coupled coil pairs;

g) selecting a fourth group n_4 of said second pair of conductors and assigning the fourth group n_4 to a fourth coil of said set of magnetically coupled coil pairs; and,

h) repeating steps e) through g) until a predetermined number of conductors are wound onto said second plurality of stator teeth to form a second magnetically coupled coil pair.

Please add new claims 20 and 21.

20. (New) A coil winding method for winding a predetermined number of conductors to form a set of magnetically coupled coil pairs on a plurality of stator teeth of a stator body in a motor, each set of coil pairs generating opposing magnetic fields in the plurality of stator teeth, the coil winding method comprising:

a) in a partial coil winding step, simultaneously winding 2n conductors together onto a first plurality of stator teeth of said stator body;

b) selecting a first group n_I of said 2n conductors and assigning the first group n_I to a first coil of said set of magnetically coupled coil pairs by, prior to performing said partial winding step, connecting said first group n_I of said 2n conductors to a first electrical connection contact on said stator body;

c) selecting a second group n_2 of said 2n conductors and assigning the second group n_2 to a second coil of said set of magnetically coupled coil pairs by, prior to performing said partial winding step, connecting said second group n_2 of said 2n conductors to a second electrical connection contact on said stator body; and,

d) repeating steps a) through c) until said predetermined number of conductors are wound onto said first plurality of stator teeth to form a first magnetically coupled coil pair of said set of magnetically coupled coil pairs.

21. (New) A coil winding method for winding a predetermined number of conductors to form a set of magnetically coupled coil pairs on a plurality of stator teeth of a stator body in a motor, each set of coil pairs generating opposing magnetic fields in the plurality of

stator teeth, the coil winding method comprising:

a) in a first partial coil winding step, simultaneously winding a first pair of conductors together onto a first plurality of stator teeth of said stator body;

b) selecting a first group n_I of said first pair of conductors and assigning the first group n_I to a first coil of said set of magnetically coupled coil pairs;

c) selecting a second group n_2 of said first pair of conductors and assigning the second group n_2 to a second coil of said set of magnetically coupled coil pairs;

d) repeating steps a) through c) until said predetermined number of conductors are wound onto said first plurality of stator teeth to form a first magnetically coupled coil pair of said set of magnetically coupled coil pairs;

e) in a second partial coil winding step, simultaneously winding a second pair of conductors together onto a second plurality of stator teeth of said stator body different from said first plurality of stator teeth;

f) selecting a third group n_3 of said second pair of conductors and assigning the third group n_3 to a third coil of said set of magnetically coupled coil pairs;

g) selecting a fourth group n_4 of said second pair of conductors and assigning the fourth group n_4 to a fourth coil of said set of magnetically coupled coil pairs; and,

h) repeating steps e) through g) until said predetermined number of conductors are wound onto said second plurality of stator teeth to form said second magnetically coupled coil pair of said set of magnetically coupled coil pairs.